

Customer No.: 31561  
Docket No.: 13875-US-PA-X  
Application No.: 10/710,199

### **REMARKS**

#### **Present Status of the Application**

The Office Action rejected claims 14-17 and 19-20 under 35 U.S.C. 103(a) as being unpatentable over Eppich (US 2004/0178458) in view of Chau (US 6,696,345). The Office Action also rejected claim 18 under 35 U.S.C. 103(a) as being unpatentable over Eppich in view of Chau and further in view of the remark.

Applicants have added the limitation of claim 15 into claim 14. After entry of the foregoing amendments, claims 14, 16-20 remain pending in the present application, and reconsideration of those claims is respectfully requested.

#### **Rejection under 35 U.S.C 103 (a)**

*Applicants respectfully traverse the rejection of claims 14, 16-17 and 19-20 under 103(a) as being unpatentable over Eppich (US 2004/0178458) in view of Chau (US 6,696,345) because a prima facie case of obviousness has not been established by the Office Action.*

To establish a prima facie case of obviousness under 35 U.S.C. 103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element in the claims. Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge

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generally available to one of ordinary skilled in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must "be found in the prior art, and not be based on applicant's disclosure." See M.P.E.P. 2143, 8<sup>th</sup> ed., February 2003.

The present invention is in general related a MOS transistor claim 14 recites:

14. A MOS transistor, comprising:

a substrate;

a gate dielectric layer on the substrate;

a stacked gate on the gate dielectric layer, comprising, from bottom to top, a first barrier layer, an interlayer, a work-function-dominating layer, a second barrier layer and a poly-Si layer, wherein the work-function-dominating layer comprises a metallic material, *and the interlayer includes a material capable of controlling a crystal orientation of the work-function-dominating layer to adjust a work function of the work-function-dominating layer*; and

a source/drain in the substrate beside the gate.

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The office action stated Eppich has disclosed the limitation of "the interlayer includes a material capable of controlling a crystal orientation of the work-function-dominating layer to adjust a work function of the work-function-dominating layer" at paragraph [0038]. However, applicant respectfully disagrees. As a matter of fact, Eppich just teaches the material, thickness and fabricating method of the layer 30 at paragraph [0038].

Please see the description of paragraph [0038] of the citation, that is "....layer 30 comprises a metal-containing material, and is formed to a thickness of less than or equal to about 20 angstrom. Layer 30 can be referred to as a second metal-containing layer to distinguish the layer from the first metal-containing layer 24. In the shown aspect of the invention, layer 30 is formed physically against dielectric material 22 across the NMOS region 12, and is formed physically against first metal-containing layer 24 across PMOS region 14. Metal-containing layer 30 can be formed by, for example, atomic layer deposition, and can be formed to a thickness of less than or equal to about 15 angstrom, and in particular aspects can be formed to a thickness of less than or equal to about 10 angstrom; alternatively, the layer can be formed with less than or equal to about 50 ALD cycles, or less than or equal to about 30 ALD cycles. Second metal-containing layer 30 can have the same composition as first metal-containing layer 24, or a different composition. Metal-containing layer 30 can predominantly comprise titanium nitride (i.e., more than 50% of metal-containing layer 30, by weight, can be titanium nitride). Metal-containing layer 30 can alternatively predominately comprise tantalum nitride, tungsten nitride or hafnium

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nitride. In particular aspects, layer 30 can comprise, consist of, or consist essentially of, one or more of elemental titanium, tantalum, tungsten and hafnium; and can comprise, consist essentially of, or consist of nitrides and/or suicides of one or more of titanium, tantalum, tungsten and hafnium".

Applicant respectfully submits "layer 30 is formed physically against dielectric material 22 across the NMOS region 12 or physically against first metal-containing layer 24 across PMOS region 14" at paragraph [0038] means *the layer 30 has a specific structure* that is against dielectric material 22 or first metal-containing layer 24 depending on applying to PMOS or NMOS. However, it does not mean or equal to "the interlayer includes a material capable of controlling a crystal orientation of the work-function-dominating layer to adjust a work function of the work-function-dominating layer" as claim 14 recites. In the present invention, the work-function-dominating layer would have a specific crystal orientation and a specific work function because of the controlling of the interlayer.

In claim 14 of the present invention, the work-function-dominating layer is disposed on the interlayer, and the interlayer includes a material capable of controlling a crystal orientation of the work-function-dominating layer to adjust a work function of the work-function-dominating layer. Therefore, the work function of the work-function-dominating layer can be adjusted by the interlayer the interlayer. In details, the interlayer can be as a nucleation layer that is capable of controlling the crystal orientation of the work-function-dominating layer. Therefore, the work function of the work-function-dominating layer is

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not only dominated by its material and phase but also affected by its crystal orientation. The two references do not teach or suggest the feature as above mentioned.

For at least the foregoing reasons, Applicant respectfully submits the references combined do not teach or suggest each and every element in claim 14, and thus a prima facie case of obviousness for claim 14 has not be established.

In addition, the office action also stated Chau teaches the word-function-dominating layer comprises a metallic material 216 and thus it would have been obvious to a person of ordinary skill in the art at the time the invention was made to form the word-function-dominating layer comprises a metallic material in Eppich's structure/device. However, applicant respectfully disagrees. Chau just teaches the second metallic layer 216 sets the overall work function of the gate electrode structure (see col. 3, lines 5-13). Chau does not teach there would be an additional layer formed between the second metallic layer 216 and the first metallic layer 214. Chau also fails to teach the work function of the second metallic layer 216 can be adjusted by a layer formed underneath. Therefore, there is not any suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skilled in the art, to combine the references in a manner resulting in the claimed invention. When obviousness is based on the teachings of multiple prior art references, the movant must also establish some "suggestion, teaching, or motivation" that would have led a person of ordinary skill in the art to combine the relevant prior art teachings in the manner claimed. See *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); *Pro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75

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F.3d 1568, 1572 (Fed. Cir. 1996). Therefore, applicant respectfully submits a prima facie case of obviousness for claim 14 has not been established.

For at least the foregoing reasons, Applicant respectfully submits independent claim 14 patently defines over the prior art references, and should be allowed. For at least the same reasons, dependent claims 16-17, 19-20 patently define over the prior art as a matter of law.

In particular, regarding to claim 16, the office action stated the limitation of "the interlayer includes a material capable of wetting a surface of the first barrier layer" has been disclosed at paragraph [0038]. However, as discussed above, Eppich just teaches the material, thickness and fabricating method of the layer 30 at paragraph [0038]. Eppich does not teach or suggest the interlayer includes a material capable of *wetting a surface of the first barrier layer* as claim 16 recites.

*Applicants respectfully traverse the rejection of claim 18 under 103(a) as being unpatentable over Eppich in view of Chau and further in view of the remark because a prima facie case of obviousness has not been established by the Office Action.*

Applicant submits that, as disclosed above, Eppich and Chau fail to teach or suggest each and every element of claim 14 from which claim 18 depends. Because a prima facie case of obviousness for claim 14 has not been established by the Office Action, claim 14 should be allowed. For at least the same reasons, dependent claim 18 patently defines over the prior art as a matter of law.

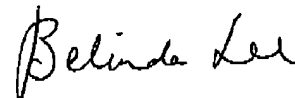
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**CONCLUSION**

For at least the foregoing reasons, it is believed that the pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Respectfully submitted,

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